

Memorandum

TO: EPA REGION 6; EPA HEADQUARTERS
FROM: JEREMY FISHER, NIDHI SANTEN, AND SPENCER FIELDS
DATE: SEPTEMBER 8, 2015
RE: ASSESSING THE DECEMBER 2014 ERCOT REPORT ON ENVIRONMENTAL REGULATIONS

Overview

At the request of EPA Headquarters and Region 6, Synapse Energy Economics (Synapse) conducted a high-level review of the Electric Reliability Council of Texas' (ERCOT's) December 2014 report, *Impacts of Environmental Regulations in the ERCOT Region*. The purpose of the review was to assess the validity of ERCOT's conclusions about potential impacts of EPA's (then) proposed Regional Haze Federal Implementation Plan (FIP) for Texas on reliability in the ERCOT system.

ERCOT is the Independent System Operator (ISO) of Texas, charged with managing grid reliability, transmission access, and the wholesale electricity market in Texas. ERCOT, as the reliability coordinator for much of the state's generation, has a mandate to examine the implications of significant shifts in the market, new market entrants, and potential changes to existing generation. ERCOT's report was designed to assess the potential impacts of existing and proposed environmental regulations on the ERCOT system, survey generation owners impacted by existing and proposed environmental regulations, examine the implications of thermal unit retirements on reliability in ERCOT, and review the reliability impacts of ERCOT's administrative rules regarding retirement.

The primary analysis within the ERCOT report is an assessment of the impacts of multiple layered environmental regulations, including the Cross State Air Pollution Rule (CSAPR), EPA's Regional Haze FIP for Texas, and a mass-based implementation of the proposed Clean Power Plan. ERCOT used an industry-standard model, PLEXOS, to examine potential buildout options and resulting economic retirements through 2029 under a set of assumptions about future fuel prices, load requirements, and costs of replacement generation. The study found that, by 2029, an additional 1,200 – 5,700 MW of coal units would retire economically above the baseline under the various environmental regulatory assumptions. Depending on the scenario, a combination of solar, gas single-cycle turbines, and wind (respectively) would replace retiring coal units. The primary PLEXOS study did not find that reliability was compromised or that energy demand would not be served. The analysis did find that ERCOT's reserve margin could fall 2-3 percent below historical targets in cases where the proposed Clean Power Plan was modeled.

ERCOT identifies 19,000 MW of existing coal capacity in the ISO; the Regional Haze FIP requires SO₂



improvements in under half of that capacity (about 8,400 MW). ERCOT's analysis found that the incremental impact of the FIP is the economic retirement of 1,900 MW of coal – or about ten percent of the coal capacity in ERCOT overall and a small fraction of the coal capacity affected by the FIP. The cases exploring the incremental impact of the proposed Clean Power Plan resulted in incremental additional retirements, but did not model the Regional Haze FIP. Because the FIP and the proposed Clean Power Plan were not simultaneously modeled, it is not clear how much of a FIP compliance benefit is realized through the Clean Power Plan (or vice versa).

Overall, the ERCOT analysis is a moderate, if narrow, assessment of the impacts of various environmental regulations and changing economic conditions in the electric sector. As with other studies from around the nation, the ERCOT study found that coal-fired generation is increasingly uneconomic due to changing market conditions, flat load, low cost renewable energy and energy efficiency, and efforts to internalize environmental damage costs through regulation. The study's model results are not reasonably interpreted to mean that environmental regulations will cause reliability problems in ERCOT.

While ERCOT's study is generally a reasonable approach to assessing long-term planning implications for projected costs and requirements, its assessment of the impacts of the Regional Haze Rule by itself is incomplete and the study relies on outdated information. The most pressing finding from the ERCOT study is not that any given rule—or even cohort of rules—will result in reliability problems, but that ERCOT's current administrative structure and market rules may be ill-suited to handle reasonably anticipated changes in ERCOT's generating fleet.

The remainder of this memo focuses on some of the main things ERCOT could have done better, which would ultimately relieve many of the reliability concerns raised in the report. We divide the memo into four main findings:

- (1) **ERCOT's perspective of market operations is short-sighted.** ERCOT raises concerns that reliability could be impacted if numerous coal units choose to retire simultaneously with little notice to either ERCOT or other market participants. Unlike other competitive market regions, ERCOT's rules do not require meaningful notice. ERCOT's charge as a reliability coordinator may obligate it to implement rules requiring reasonable notice for economic retirements.
- (2) **ERCOT's assumptions about new gas turbine capacity are not realistic.** While the FIP, along with other environmental regulations ERCOT included in its study, will strain the economic viability of coal plants and likely lead to less coal capacity, ERCOT has not considered new resources that will be available to help address potential reliability challenges. Specifically, ERCOT does not include approximately 4,500 MW of additional gas-fired capacity coming online in Texas in the upcoming years. This represents 7.5 percent of current gas capacity, and would double the modeled baseline gas capacity additions through 2029.
- (3) **The set of regulatory scenarios modeled is both incomplete and (now) outdated.** Despite an overall thorough analysis, ERCOT excluded a critical scenario that would have modeled the impact of the Regional Haze Program FIP by itself. This limits inferences we can make about



impacts. Additionally, since ERCOT finalized its study, EPA finalized the Clean Power Plan. The final rule includes substantive changes that are likely to affect all of the CO₂ limit and price-inclusive scenario modeling results.

- (4) Electric Generating Unit owners' compliance "burdens" with the Regional Haze FIP may be over-stated.** Of the 15 coal-fired units subject to Regional Haze compliance requirements, eight require upgrades to their existing scrubbers rather than new scrubbers. ERCOT assumed that all of the scrubbers would be priced at the cost of a new retrofit, thereby substantially increasing the cost of the regulation.

Synapse's Review of ERCOT's Assessment

ERCOT's perspective of market operations is short-sighted.

There is significant opportunity to address concerns about potential future reliability issues through administrative market changes, which ERCOT appears to de-emphasize. ERCOT's analysis shows that with sufficient notice and lead time, their system can use new and existing resources to effectively respond to capacity and energy requirements while allowing for cost effective retirements. Nonetheless, ERCOT raises the concern that their administrative rules prevent market participants from effectively planning, and thus engender a reliability concern. This concern is not a function of EPA's rulemaking process, but rather a function of ERCOT's market rules.

A key issue raised by ERCOT is the system operator's blindness to upcoming retirements due to the structure of current regulations: ERCOT requires units to provide only 90 days' notice before deactivating. As a result, while the system operator may have an idea of which units may retire and when, there is no obligation to tell ERCOT until just before they ultimately retire. ERCOT raises the concern that neither they nor other market participants can reasonably respond to multiple simultaneous retirements with such short notice.

While any unit anywhere is capable of turning off tomorrow without providing advanced notice to the system operator, around the country there are layers of rules that prohibit this from happening. Vertically integrated utilities plan deactivations well in advance and ensure replacement capacity prior to removing capacity. Within such a utility, a failure to provide a reliable system given reasonably anticipated changes would be deemed imprudent by any regulator. Other market regions maintain reliability in the face of retirement through market structures and administrative rules.

Synapse reviewed deactivation rules in other markets, and at present, only one other system operator studied requires merely 90 days' notice from generators before deactivation: the Pennsylvania Jersey Maryland RTO (PJM).¹ PJM, however, maintains a forward capacity market that incentivizes units to disclose plans at least three years in advance of a retirement or delisting. If a unit clears the forward capacity market in PJM, it is obligated to provide capacity three years into the future at a given price. If

¹ PJM, Manual 14D, Section 9.1, page 68. Available at: <http://www.pjm.com/~media/documents/manuals/m14d.ashx>.



the unit retires before fulfilling that obligation, it would face heavy fines or, alternatively, need to procure other capacity to fill that gap at substantial cost. Ultimately, even in PJM where units are technically only required to provide 90 days' advance notice before retiring, units will generally provide more advance notice by not participating in the capacity market. PJM further maintains a structure for ensuring reliability even if the market has not appropriately reacted to an anticipated unit retirement. PJM studies unit deactivations, and designates units as Reliability-Must-Run (RMR) if their retirement poses a reliability concern. RMR units are provided additional revenue to ensure that they remain economic until such time as the reliability concern can be mitigated.

Other system operators across the United States require more advanced notice from generators planning to deactivate. The Midcontinent Independent System Operator's (MISO) deactivation process requires 26 weeks', or a half-year's, notice.² During those 26 weeks, MISO conducts a study to determine whether or not the unit is required for reliability purposes. If so, then MISO has the right to require that unit to remain online as a System Support Resource. Similar to the RMR construct in PJM, System Support Resources receive additional revenue to remain economic (and thus online) until an alternative (and lower cost) mitigation can be put in place.³

In New England, the system operator (ISO-NE) requires nearly three and a half years advanced notice for retiring units. Similar to PJM, ISO-NE has a forward capacity market through which the operator guarantees reliability three years into the future. Unlike PJM, however, ISO-NE explicitly requires generators to submit retirement requests during the existing capacity qualification phase of a capacity auction. The requests are submitted four months before the auction itself occurs, or three years and four months before the capacity commitment.⁴ This way, developers can be aware of potential areas where new generation will be needed and respond as such in the market.

A final example, and perhaps most useful for ERCOT, is the New York ISO (NYISO). In the past, NYISO required 90 or 180 days' advanced notice (depending on resource type) for deactivating units. After recognizing and expressing similar concerns to those described in the ERCOT report, NYISO recently submitted a proposal to FERC to change its tariff to require a full year of advance notice from units choosing to retire.⁵ This regulatory change would allow NYISO adequate opportunity to review any potential reliability issues associated with a given facility's retirement. By following the lead of NYISO and the other system operators around the country, ERCOT could greatly reduce one of the major causes for concern in the December 2014 report.

² MISO tariff, Attachment Y. "Notification of Potential Generation Resource/SCU Change of Status"
https://www.misoenergy.org/_layouts/MISO/ECM/Download.aspx?ID=96704

³ System Support Resources in MISO Markets. November 2011.
<https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/MSC/2011/20111101/20111101%20MSC%20Item%2007d%20SSRs%20in%20MISO%20markets.pdf>

⁴ ISO New England. Market Rule 1. III.13.1.10.(e). http://www.iso-ne.com/static-assets/documents/regulatory/tariff/sect_3/mr1_sec_13_14.pdf

⁵ https://www.nyiso.com/public/webdocs/markets_operations/committees/bic_icapwg/meeting_materials/2015-08-10/ippnyrmrproposalcomments5%2026%2015.pdf

It is particularly important to note that ERCOT's concern about the simultaneous retirement of significant capacity is not imminent. EPA's Regional Haze FIP was published in December 2014, and gave units five years to comply with the requirements of the plan – i.e. December 2019. This is adequate time to conduct reasonable planning: determine which units are likely to retire, ensure an administrative structure is in place to address potential reliability concerns, and address any concerns well before the compliance deadline.

ERCOT's assumptions about gas turbine capacity additions and their usefulness are not realistic

Throughout the report, ERCOT states that coal unit retirements have the *potential* to disrupt grid operations and cause reliability challenges. In scenarios modeled with CO₂ limits and/or prices when much more variable renewable resources such as solar and wind come online, the loss of ancillary services can pose operational challenges to grid operators. These operators must quickly respond to changes in load on a more regular basis, but with less spinning reserve. ERCOT finds that Regional Haze requirements result in a quadrupling of coal retirements by 2029 from the baseline scenario (3,900 MW compared to 800 MW in the baseline), and a doubling of coal retirements from the scenario that includes only the Cross-State Air Pollution Rule (CSAPR) (3,900 MW compared to 2,000 MW).

ERCOT's model adds capacity additions of flexible, fast-ramping natural gas combustion turbines, but their contribution to ERCOT reliability are only lightly acknowledged and significantly understated. Fast-ramping gas resources are able to replace many of the reliability services provided by coal, and are generally better suited to offset intermittency issues from renewable resource additions. Well-managed, well-placed gas resources can handle all the ancillary services that will be required in ERCOT as additional renewable energy comes online, such as rapid response, frequency regulation, and voltage support. In fact, ERCOT implemented an Ancillary Services market specifically to incentivize the creation and operation of units capable of providing rapid responses.

ERCOT also raises the issue of where new gas resources will be sited compared to current coal resources. In particular, they identify a problem wherein new gas resources may be sited at a different location than retired coal resources, thus stressing transmission. While we agree that appropriate siting and transmission buildout are important components of designing an efficient and reliable electric power system, this concern is well within ERCOT's jurisdiction and capability to address. In general, the robustness of Texas's current natural gas infrastructure and its proximity to load centers, combined with the reality that new gas units are often sited in planning zones with existing electric generating units (for ease of permitting and other integration issues), means that on balance new fossil resources are likely to be located in areas where they can provide reliability services.

Another concern with ERCOT's December 2014 study is that the data source is stale with regards to new gas likely to come online in ERCOT. New data is available that shows additional gas resource capacity scheduled to come online in ERCOT in the near future. ERCOT's December 2014 study uses data from the May 2014 Capacity, Demand, and Reserves (CDR) report, with some adjustments for units that started construction soon afterwards and additional Private-Use Network capacity.⁶ However, between

May 2014 and December 2014 when the next CDR was published, another 1,908 MW of gas was added to the “planned resources” category and another 2,109 MW was updated from planned to operational. Between the December 2014 CDR and May 2015 CDR, yet another 2,591 MW was added to the planned resource category.^{7,8} Leaving aside the amount of planned generation that ERCOT included in its study that had started construction by Summer 2014, this amounts to approximately 4,500 MW of additional gas capacity that would be included in the analysis if ERCOT was to conduct the study today. This additional capacity amounts to approximately 7.5 percent of the baseline natural gas capacity (58,900 MW), and is well in excess of the amount of capacity that could conceptually retire due to the Regional Haze FIP. For comparison, the additional 4,500 MW that could be included in the baseline is equivalent to approximately 100 percent of the new gas capacity additions by 2029 in the modeled baseline and CSAPR scenarios (4,600 MW), and about 70 percent of the new gas capacity in the CSAPR plus Regional Haze scenario (6,400 MW). If planned resources as designated by the CDR account for nearly all or a majority of the natural gas expansions modeled as optimal for ERCOT under environmental regulations, the reliability issues that ERCOT cites may be grossly overstated.

In addition to the 4,500 MW in CDR-reported planned natural gas plants introduced since the version of the CDR that ERCOT used in its study, there is a large capacity of natural gas-fired generation with initial New Source Review construction permits in pending status at TCEQ. Synapse estimates from a review of TCEQ’s air permits database that, as of the writing of this memo, over 10,000 MW of new gas-fired generation could potentially come online in the next 2-5 years (cumulatively).⁹ It is not unheard of for permit applications to be withdrawn by the owner while in pending status (for various technical and/or economic reasons). It is also possible for permits to be approved only after iterations with the owner to scale back the number of turbines requested in the application or make other decisions that affect new unit effective capacities. However, new construction permit applications that are submitted represent a relatively serious commitment from the applicant to build this generating capacity. Preparing an initial New Source Review construction permit for a new gas unit is a lengthy and non-trivial exercise. At the time of application, owners have typically selected a specific site for the new unit, verified its feasibility in the selected location (e.g., space at the site, access to gas infrastructure), hired an owner’s engineer for the project, and are conducting air quality modeling studies to clear New Source Review requirements. Together, these activities represent a substantial amount of time and financial investment. Thus, while pending permits *may* not be realized in constructed units, more often than not at the time of application, owners know they will be building a certain amount of capacity during a certain timeframe. The permitting process is used to develop the “best conditions” upon which they will

⁶ ERCOT (2014), “Report on the Capacity, Demand, and Reserves in the ERCOT Region,” December 2014, Available at: <http://www.ercot.com/content/gridinfo/resource/2015/adequacy/cdr/CapacityDemandandReserveReport-Dec2014.pdf> (page 16)

⁷ ERCOT (2014), “Report on the Capacity, Demand, and Reserves in the ERCOT Region,” December 2014, Available at: <http://www.ercot.com/content/gridinfo/resource/2015/adequacy/cdr/CapacityDemandandReserveReport-Dec2014.pdf>

⁸ ERCOT (2015), “Report on the Capacity, Demand, and Reserves in the ERCOT Region,” May 2015, Available at: <http://www.ercot.com/content/gridinfo/resource/2015/adequacy/cdr/CapacityDemandandReserveReport-May2015.pdf>

⁹ TCEQ (2015) Air Permits Database, New Source Review Permits, Available at: <http://www2.tceq.texas.gov/airperm/index.cfm?fuseaction=airpermits.start>



be able to build and operate their new unit(s).

Combined, the amount of planned generation resources in the CDR reports since May 2014 and the pending construction permits in the queue at TCEQ (a total of approximately 14,500 MW) represent a significant amount of new generation that can mitigate reliability concerns from the 3,900 MW of potential coal retirements from the Regional Haze FIP. In particular, it is notable that many of these new gas units will come online in the next 2-5 years based on their current permitting status and relatively short construction times – ahead of economic coal unit retirements between 2019 and 2022.

The set of regulatory scenarios ERCOT modeled is limited and/or no longer applicable

ERCOT's main findings for Regional Haze-induced coal unit retirements and gas turbine capacity additions are based on a modeling scenario that accounts for the cumulative impacts of Regional Haze and CSAPR. The addition of Regional Haze requirements results in approximately 1,900 MW of additional coal retirements compared to the scenario with just CSAPR, and more than 3,000 MW compared to the baseline. Total fossil retirements in these scenarios are partially mitigated by the fact that there is less gas retirement in these scenarios than in the baseline due to relative preference for gas over coal to meet both of the additional SO₂ requirements.

Unfortunately, the ERCOT study—while comprehensive in many ways—does not model a Regional Haze-only scenario, so at a high level it is not possible to tell what the impact of Regional Haze requirements are themselves (without simultaneous CSAPR limits). ERCOT shows that the total capacity additions through 2029 do not change between the baseline and CSAPR-only scenario, and appears to use this lack of change as a basis for making inferences about the impact of the Regional Haze requirements when Regional Haze requirements are added to the CSAPR scenario. However, as the modeling shows, all impacts are not the same. Unit retirements change, as does the resulting generation mix, over time. Sound scenario modeling would assess the Regional Haze FIP as a stand-alone scenario in order to isolate its effects on capacity changes. Without this, it is impossible to untangle CSAPR effects from Regional Haze FIP effects. As CO₂ limits and Clean Power Plan impacts are modeled in later scenarios without the Regional Haze FIP, the story becomes even more complicated.

Throughout the report, ERCOT states that the impacts of imposing proposed Clean Power Plan-like constraints on the system are increased renewable capacity additions (wind and a substantial amount of solar) and further coal retirements (3,300 MW to 5,700 MW of incremental coal retirements compared to the baseline). Under these CO₂ constraints, new gas resource additions *also* decrease relative to the baseline, in favor of more renewables. This combination of significant penetration of renewables (particularly solar), increased coal unit retirements, and suppressed new gas additions is a visual that ERCOT paints for the reader as one that can result in serious reliability issues. In two of the three carbon limit/price scenarios, ERCOT predicts tight capacity reserve margins for the early years (2020 and 2022) of proposed Clean Power Plan compliance requirements—2 to 3 percent below the reserve margin from the baseline scenario. The report describes that, in modeling, new replacement capacity and energy efficiency programs were not fully in place until 2022, thus causing the marginal shortfall. Finally, ERCOT notes that at the time of the study, there was still uncertainty with respect to Texas's final Clean Power

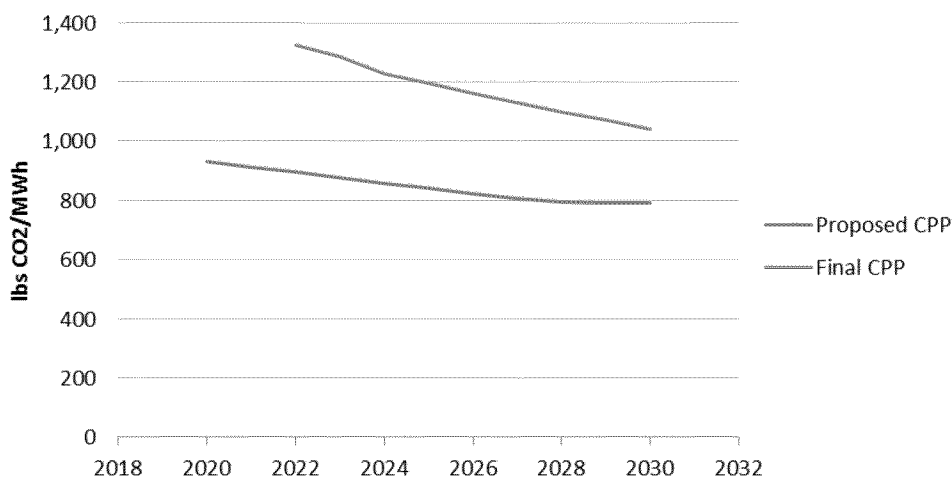


Plan requirements and whether or not regional coordination and trading programs would be permitted. Support for a reliability safety-valve process is also included.

There are a number of notable differences between the proposed Clean Power Plan rule modeled in the ERCOT study and the finalized rule of August 2015, each of which Synapse believes will only lessen any reliability challenges ERCOT cites.¹⁰

- First, the compliance period for the Clean Power Plan has shifted, and the first year of compliance is now 2022 instead of 2020. While there are incentives for early actions, this change should largely alleviate concerns about reserve margin size because Texas will now have an additional two years to have energy efficiency and other measures materialize before compliance begins.
- Second, ERCOT's requirements under the final Clean Power Plan are substantially less stringent than under the proposed rule. As shown in Figure 1, below, the compliance requirement is over 40 percent less stringent at the start of compliance, and over 30 percent less stringent in the final compliance year. One could expect that this change in requirement will result in fewer economic coal unit retirements.

Figure 1. Texas Clean Power Plan Rate Targets (lbs CO₂/MWh) under proposed and final rule



- Third, multi-state and/or regional state plan submissions are permitted under the final Clean Power Plan, as are interstate emissions trading programs. The finalization of these provisions provide ERCOT with a significant amount of flexibility with which to manage the operations of its grid.
- Finally, the final rule includes a reliability safety valve for individual sources in the event that there is a conflict between the state's plan and a significant reliability concern or extreme event. EPA states that these circumstances will be rare—citing other flexibility

¹⁰ U.S. EPA. 2015. Clean Power Plan (add citation detail)

provisions such as trading—as a mitigating factor; but it is in agreement that such a precaution is warranted. The safety valve mechanism in the final rule should ease additional reliability concerns ERCOT has raised in reference to Clean Power Plan requirements.

Compliance “burdens” for the Regional Haze FIP are overstated.

As a final point, Synapse has concerns that ERCOT used an inaccurate key capital cost assumption in the December 2014 study for Regional Haze FIP compliance that may be driving some of the deep coal retirements witnessed in the modeled scenarios. This adds to what we believe is already an overstated reliability concern. As the study report states, ERCOT used the same capital costs for scrubber upgrades and scrubber retrofits, citing data limitations as the basis for this modeling decision. In effect, ERCOT is using the capital costs for a full flue-gas desulfurization system (FGD) installation to cover Regional Haze FIP requirements rather than allowing for a more modest scrubber upgrade at units for which it makes more economic sense. A scrubber upgrade may be a fraction of the cost of a full FGD system, depending on the characteristics of the existing system and required infrastructure. It may therefore not be appropriate to model these options as the same. This is particularly pertinent considering the fact that the Regional Haze program does not prescribe one technology over another for compliance. The choice to install a high cost FGD system, as in ERCOT’s Regional Haze plus CSAPR scenario, may induce many marginal economic coal units to retire instead of retrofit. Synapse does not believe the data limitation concern to be sufficient. The cost technical support document of the state’s Best Available Retrofit Technology analysis conducted for the FIP contains several estimates of scrubber upgrade costs used by other utilities.

Conclusion

ERCOT’s December 2014 assessment of the impact of existing and pending environmental regulations is a reasonable, although outdated, analysis of potential electricity system changes that may occur in ERCOT through 2029. As with many other studies of the electric sector, the study identifies that existing coal units are already marginal in Texas, and may choose economic retirement as a mechanism to meet environmental requirements. This decision matrix is not new or unexpected: falling electricity prices, flat demand, and the low cost of renewable energy and efficiency are leading to the decision to retire existing high cost coal units throughout the country.

ERCOT’s concerns about these changes as recognized in the model appear to be misplaced and incorrectly emphasized. In particular, ISOs and vertically integrated utilities have found that they can accommodate even large unit retirements with sufficient and comprehensive planning. ERCOT’s primary concern is that current administrative rules will not provide a sufficient market response to bring additional capacity online. ERCOT, as the reliability coordinator for much of Texas, is charged with maintaining a reliable system both in the short term and over the long term. Improvement in the ISO’s planning and administrative structure should be able to readily accommodate expected economic retirements, while supporting reliability.

ERCOT’s report is outdated with respect to the amount of new gas capacity likely to come online in the



near future. The use of current information should mitigate some of the ISO's concerns. In addition, the report uses the proposed version of the Clean Power Plan as the basis of its most aggressive retirement scenario. The finalized version of the Clean Power Plan is less stringent in Texas, and thus is likely to have far less impact. Finally, the report likely overstates the cost of retrofits in the Regional Haze FIP because it fails to distinguish units that require upgrades to existing equipment versus units that require new large capital investments.

Overall, ERCOT's report draws attention to the ISO's administrative rules, and potential concerns if ERCOT's retirement and delisting structure is not improved. However, while ERCOT's assessment is a valuable planning tool (albeit narrowly focused), it is our opinion that it does not warrant specific concern with regard to the reliability implications of the Regional Haze Rule FIP.

